

Fast deposition of elongated Nickel nanowires inside nanoporous alumina templates

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One-dimensional metallic nanostructured materials have attracted extensive attention in recent years because of their technological importance in nanometer-scale devices and information storage systems. By combining deposition techniques with highly ordered nanoporous templates we can easily tune the growth of these nanostructures and form nanowires (NWs) with controlled diameters and lengths.

In this work we used electrochemical techniques to fabricate Ni NWs [1] inside nanoporous alumina templates. The depositions were performed in a Watts bath, applying a constant potential using 3 electrodes: gold sputtered on one side of the porous membrane as working electrode (WE), platinum mesh as counter electrode (CE) and Ag/AgCl (in KCl) as reference electrode. Linear voltammetry was performed prior to the deposition process in an attempt to find the optimum potential for Ni deposition. We present a comparative study of the deposition process at different constant potentials. The deposition rate was found to be different for each potential. Furthermore, the maximum length of the nanowires grown was found to depend on the applied potential, so that, for lower potentials, the nanowires do not reach the top of the 50 μm membrane. The uniformity of the Ni deposition was found to be dependent on the quality of the membranes and gold contact underneath. The length of the NWs (5 to 50 μm) was controlled by the time of deposition, for a specific applied potential, and their outer diameters correspond to the alumina pores' diameter (30 to 200 nm).

A study of the structural, morphological and magnetic properties of the Ni NWs was performed using Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD) and Vibrating Sample Magnetometer (VSM).

References

[1] K. Nielsch *et. al.*, Applied Physics Letters, **79** (2001) 1360-1362.

Figures

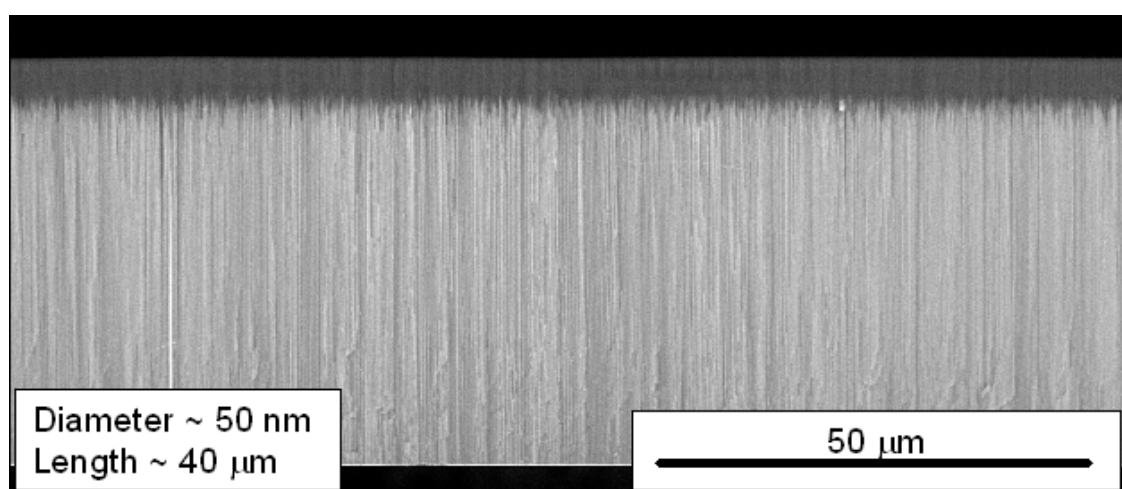


Fig. 1. SEM image of nickel nanowires electrodeposited inside a nanoporous alumina membrane

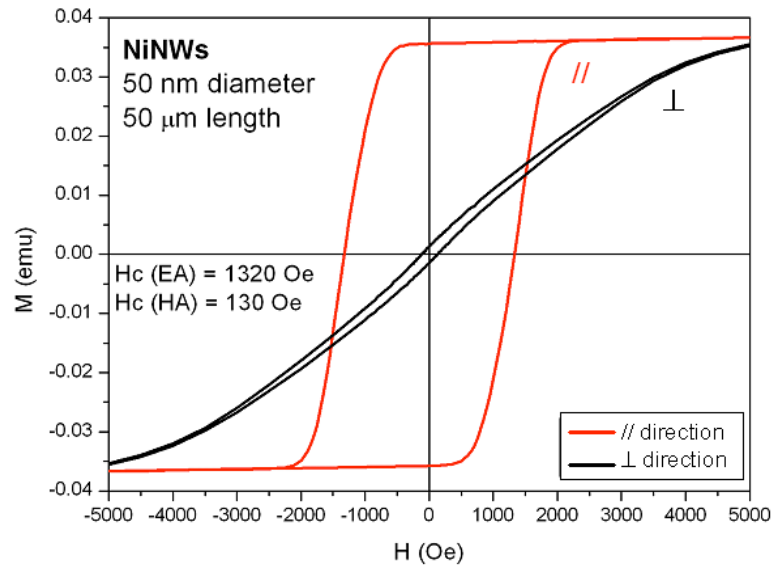


Fig. 2. Magnetization curve of nickel nanowires electrodeposited inside a nanoporous alumina membrane